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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,076	02/10/2004	Madhav Datta	42P11468D	2094
7590 07/26/2005			EXAMINER	
Michael A. Bernadicou BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP Seventh Floor 12400 Wilshire Boulevard Los Angeles, CA 90025			PHAM, THANHHA S	
			ART UNIT	PAPER NUMBER
			2813	
DATE MAILED: 07/26/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

<b>Office Action Summary</b>	<b>Application No.</b> 10/776,076	<b>Applicant(s)</b> DATTA ET AL.	
	<b>Examiner</b> Thanhha Pham	<b>Art Unit</b> 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 18 May 2005.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 12-14, 17-19 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14 is/are allowed.
- 6) ☒ Claim(s) 12, 13, 17-19 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413)          |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. <u>07/22/2005</u> .                                  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>05/18/2005</u> .  | 6) <input type="checkbox"/> Other: _____.                                   |

## DETAILED ACTION

This Office Action is in response to Applicant's Amendment dated 05/18/2005.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**1. Claims 12-13 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Bhattacharya [US 4,514,751].**

► With respect to claim 11, Bhattacharya (fig. 3, cols. 1-4) discloses the claimed process comprising:

forming a metallization (3, fig 3, col. 2 lines 25-40) over a substrate (2);

forming a metal adhesion first layer (10, Ti, fig 3, col. 3 lines 42-54) above and on the metallization (3);

forming a metal second layer (11, Cu, fig 3, col. 3 lines 42-54) above and on the metal adhesion first layer (10);

forming a metal third layer (12, Ti, fig. 3, col. 3 lines 42-54) above and on the metal second layer (10);

forming a solder bump (1, fig. 3, col 3 lines 56) above and on the metal third layer (10), and

wherein the metal second layer (10, copper) comprises a copper and the metal third layer (12, Ti) is selected from the group consisting of a refractory metal, a metal-doped refractory metal, and a refractory metal alloy.

► With respect to claim 13, Bhattachary (cols. 2-3) discloses forming the metal adhesion first layer (10, Ti) comprising sputtering a composition over the metallization under condition to impart a compressive stress in the metal adhesion first layer wherein the composition is selected from Ti, TiW, W and Cr.

► With respect to claim 17, Bhattachary (cols 1-2) discloses forming an electrically conductive bump (1) above and on the metal third layer (12).

**1. Claims 12 and 17-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Huang [US 6,452,270].**

► With respect to claim 12, Huang (figs 1-8 and cols. 1-5) discloses the claimed process comprising:

forming a metallization (320, fig. 3, col. 4 lines 26-29) over a substrate (310);

forming a metal adhesion first layer (340a, fig. 3, col. 4 lines 26-29) above and on the metallization (320);

forming a metal second layer (340b, copper, fig. 5, col. 4 lines 33-38) above and on the metal adhesion first layer (340a);

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forming a metal third layer (340c, nickel-vanadium, fig. 5, col. 4 lines 33-38) above and on the metal second layer (340b);

forming a solder bump (350, fig. 7, col. 4 lines 39-45) above and on the metal third layer (340c), and

wherein the metal second layer comprises a copper and the metal third is selected from the group consisting of a refractory metal, a metal-doped refractory metal, and a refractory metal alloy.

► With respect to claim 17, Chiang discloses forming an electrically conductive bump (bump electrode 350) above and on the metal third layer (340c).

► With respect to claim 18, Huang (figs 1-8 and cols. 1-5) discloses the claimed process comprising:

forming a copper pad (320, fig. 3, col. 4 lines 26-29) over a substrate (310);

sputtering a Ti adhesion first layer (340a, fig. 3, col. 4 lines 26-29) above and on the copper pad (320);

sputtering a metal second layer (340b, copper, fig. 5, col. 4 lines 33-38) above and on the Ti adhesion first layer (340a);

forming a metal third layer (340c, nickel-vanadium, fig. 5, col. 4 lines 33-38) above and on the metal second layer (340b);

forming a solder bump (350, fig. 7, col. 4 lines 39-45) above and on the metal third layer (340c), and

wherein the metal second layer comprises a copper and the metal third is selected from the group consisting of a refractory metal, a metal-doped refractory metal, and a refractory metal alloy.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**2. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang [US 6,452,270] in view of Bhattacharya [US 4,514,751].**

Huang substantially discloses the claimed process including forming the metal adhesion first layer comprising sputtering a composition over the metallization wherein the composition is selected from Ti, TiW, W and Cr. Huang use said metal adhesion first layer as a portion of the UBM for solder bump in subsequent process step.

Chiang does not expressly teach forming said metal adhesion first layer by sputtering the composition under conditions to impart a compressive stress in said metal adhesion first layer.

However, Bhattacharya (fig. 1, col. 2 lines 53-58 and col. 3 lines 1-26) teaches forming the metal adhesion layer (Ti) by sputtering/evaporation deposition under conditions to impart compressive stress in the metal adhesion layer (Ti) as a portion of

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the UBM for solder bump (1) to prevent cracking problem when forming the solder bump.

Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Huang by forming the metal adhesion first layer using sputtering under conditions to impart compressive stress as taught by Bhattacharya to prevent cracking problem when forming the solder bump for electrical connection.

**3. Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang [US 6,452,270] in view of Chiang [US 2002/0086520].**

► With respect to claim 21, Huang (figs 1-8 and cols. 1-5) substantially discloses the claimed process comprising:

forming a copper pad (320, fig. 3, col. 4 lines 26-29) over a substrate (310);

sputtering a Ti adhesion first layer (340a, fig. 3, col. 4 lines 26-29) above and on the copper pad (320);

sputtering a metal second layer (340b, fig. 5, col. 4 lines 33-38) above and on the Ti adhesion first layer (340a);

forming a metal third layer (340c, nickel-vanadium, fig. 5, col. 4 lines 33-38) above and on the metal second layer (340b);

forming a solder bump (350, fig. 7, col. 4 lines 39-45) above and on the metal third layer (340c), and

wherein forming the metal third layer (340c) comprising sputtering a NiV composition over the metal second layer (340b).

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Huang is silent about thicknesses of the metal second layer and the metal third layer as being claimed.

However, the claimed range thicknesses is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*See also In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).



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► With respect to claim 19, the claimed range thickness of the Ti composition over the copper pad is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. See *In re Aller* 105 USPQ233, 255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

#### ***Allowable Subject Matter***

4. Claim 14 is allowed.

5. The following are statements of reasons for the indication of allowable subject matter:

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 14 including sputtering a copper metal second layer over the metal adhesion first layer under conditions to impart a compressive stress therein; forming a third metal layer above and on the copper metal second layer under condition to impart a compressive stress therein wherein the metal third layer is selected from a group consisting of a refractory metal, a metal doped refractory metal and a refractory metal alloy; forming a solder bump above and on the third layer.

***Response to Arguments***

6. Applicant's arguments with respect to claims 12-13, 17-19 and 21 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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